

U.S. FISH AND WILDLIFE SERVICE
Pacific Islands Office, Ecological Services



**SURVEYS OF FOREST BIRD POPULATIONS FOUND IN
THE VICINITY OF PROPOSED GEOTHERMAL PROJECT SUBZONES
IN THE DISTRICT OF PUNA, HAWAI'I**

Prepared by:

James D. Jacobi, Michelle Reynolds, George Ritchotte,
Bonnie Nielsen, Anthony Viggiano, and Jill Dwyer

U.S. Fish and Wildlife Service
Hawai'i Research Station
P.O. Box 44
Hawai'i National Park, HI 96718

Submitted to:

Andrea W. Campbell
U.S. Department of Energy, Oak Ridge
P.O. Box 2001
Oak Ridge, Tennessee 37831-8739

October 1994

01 MAR 14 PM 10:04 WATER & LAND

TABLE OF CONTENTS

List of tables	ii
List of figures	iii
Introduction	1
Project objectives	2
Methods	3
Results	4
Species distributions within the two lower subzones	4
Detailed population surveys in the vicinity of the Middle East Rift subzone	5
Discussion	5
Native bird populations	5
Introduced bird populations	7
Management of potential impacts of the proposed geothermal development on native forest bird populations	7
Literature cited	9

LIST OF TABLES

Table 1.	Bird species detected during surveys in the Puna district between August 1993 and February 1994	12
Table 2.	Species detected during point count surveys in habitats located within the two lower subzones in the Puna study areas	13
Table 3.	Summary of VCP bird counts in the Middle East Rift geothermal subzone	14

INTRODUCTION

The endemic land birds of Hawai'i, particularly the Hawaiian honeycreepers, an endemic subfamily of the cardueline finches, provide one of the world's most dramatic examples of adaptive radiation and speciation in island ecosystems (Freed et al. 1987, Scott et al. 1988). From what is believed to have been a single successful colonization of the Hawaiian archipelago by an ancestral species from North America, the honeycreepers evolved into a diverse array of species and subspecies of birds with bills ranging from thick, seed-eating beaks of the Palila (*Loxioides bailleui*), small insectivorous bills as seen on the 'Amakihi (*Hemignathus virens*), woodpecker-like adaptations of the 'Akiapola'au (*Hemignathus munroi*), and large, decurved nectar-feeding bills of the 'I'iwi (*Vestiaria coccinea*). In addition to the honeycreepers, the historically documented endemic Hawaiian avifauna included other perching birds with a species of crow, and representatives of honeyeaters, thrushes, and Old World flycatchers; three seabirds; several waterfowl and two raptors. In all, 71 endemic species and subspecies of Hawaiian birds were known to exist at the time of Captain Cook's discovery of the Hawaiian Islands in 1778 (Berger 1981, Scott et al. 1986).

The arrival of humans to the Hawaiian Islands--starting with the Polynesians over 1,500 years ago and continuing following European contact--drastically changed many natural ecosystems, leading not only to the extinction of many plant and animal species, but also to a significant reduction in both range and abundance for many other taxa. Originally, the Hawaiian birds were found in all habitat zones on each island, including high-elevation communities on the large mountains on Hawai'i and Maui, the wet and moist forest zones on the windward and leeward sides of each island, and down to the lowland and coastal communities that provided additional wetland habitat for waterbirds and shorebirds (Berger 1981). Today, few native forest birds can be found below 610 m (2,000 ft) elevation, and many of the wetland areas that used to provide abundant habitat for waterbirds have been destroyed.

Of the historically documented 71 taxa of endemic Hawaiian birds, 23 are now extinct, and 31 of the remaining 48 species and subspecies are listed as Endangered or Threatened by the U.S. Fish and Wildlife Service (1992), many with few or only single populations remaining. Thus, 76% of the Hawaiian birds are either extinct or endangered, and several of the remaining unlisted species are showing significant population declines. Studies of recently discovered fossil bird bones have further identified nearly 40 additional species of Hawaiian birds never seen alive by the post-Cook naturalists; these became extinct after the Polynesians arrived (Olsen and James 1982; H. James, Smithsonian Institution, personal communication).

Many different factors have been suggested to explain the decline of Hawaiian bird species since human colonization (Ralph and van Riper 1985; Scott, et al. 1988). The most important and plausible of these include habitat loss (Berger 1981; Kirch 1982; Olsen and James 1982; Jacobi and Scott 1985), susceptibility to introduced avian diseases

2. Evaluate changes in bird populations within the upper Middle East Rift subzone since the original Hawai'i Forest Birds Survey in 1979.
3. Assess distribution and abundance of forest bird populations relative to distance from roads within native forest habitat in the upper Middle East Rift subzone.

Due to restricted land access in the Middle East Rift subzone, particularly for the lands controlled by True/Mid-Pacific and Campbell Estate, objective 3 was abandoned. Additionally, limited access to many sections of the Kama'ili and Kapoho subzones, and limited access into the Middle East Rift subzone reduced the opportunity to conduct some of the detailed forest bird surveys in support of objectives 1 and 2 as planned. However, the results presented in this report provide new data and interpretations of previous data pertinent to evaluating some of the potential impacts of proposed geothermal resource development within the Puna district.

METHODS

Field surveys for this project were conducted during August 1993 - February 1994. Several types of survey techniques were used to sample areas of varying accessibility.

1. The Area Search (AS) method is a timed walking survey in a limited area generally only accessible by foot, or where transect sampling was unfeasible (Ambrose 1989). This method allows the observer to compile a list of birds found within a sample area. AS surveys were conducted for periods of twenty minutes per selected survey site (Figure 2).
2. Extensive point surveys (EPS) were conducted using roads as transects with point stops every 3.2 km (2 miles) (Figure 3). Intensive point surveys (IPS) were conducted in several fragmented habitats (Figure 2). Survey points were placed at closer intervals than for the EPS sampling (0.8 km; 0.5 miles), so that all avian species detectable would be identified despite vegetation changes along the route. Data collected by these methods were summarized by number of birds per sample hour.
3. Variable circular plot (VCP) counts, following the methodology described by Scott *et al.* (1986), were conducted on 117 stations located on four transects established within the Kahauale'a Natural Area Reserve, just above the upper boundary of the Middle East Rift geothermal subzone (Figure 4). Two of these transects (37 and 38) included stations sampled during the 1979 Hawai'i Forest Bird Survey. The other two transects were established between the original transects to increase sample size in this area during the 1993 survey.

The AS, EPS, and IPS methods were used in areas that were either too small or too fragmented to allow for enough similar samples necessary for quantitative sampling by

The most common species throughout the lower two subzones was the introduced Japanese white-eye, followed closely by the introduced House finch (Table 2). All of the endemic forest bird species in these lower two subzones were found in areas dominated by native vegetation, primarily an 'ohi'a (*Metrosideros polymorpha*) forest with a mixture of native tree, shrub, and fern species.

Detailed population surveys in the vicinity Middle East Rift subzone

Detailed surveys of bird populations conducted within the Kahauale'a NAR in June-July 1979 and December 1993 recorded a total of 14 species of birds, only six of which were recorded in both counts (Table 3). Although these counts were conducted at different times of the year, the sampling periods were both during the non-breeding season, either after the end of breeding (June 1979) or just prior to the start of breeding (December 1993). Based upon previous surveys of bird populations in this habitat and elevational range in other sections of the island of Hawai'i, the June and December counts were considered to be sampling comparable segments of the bird community.

The endangered 'O'u (*Psittitostra psittacea*) and the endemic 'I'iwi (*Vestiaria coccinea*), both rare during the 1979 counts, were not located anywhere in the study area during the 1993 survey. Two other species, the endemic 'Amakihi and the introduced House finch, were also not recorded during the 1993 VCP counts, but were commonly found in other parts of the study area. Three of the four species found along the transects only during the 1993 survey (Hawaiian Hawk, Red-billed Leiothrix, and Spotted dove) were similarly located elsewhere during the 1979 surveys (Scott *et al.* 1986). However, the Kalij pheasant is a species that has moved into the Puna forests only since the mid-1980's (Scott *et al.* 1986).

Four species of birds common to both the 1979 and 1993 VCP counts had sample sizes large enough for comparison between the years. Two of these species, 'Apapane and 'Oma'o showed similar or only slightly reduced status in frequency (Figure 6), birds per count period (Figure 7), and population density (Figure 8). The 'Elepaio population was considerably reduced in the 1993 count with more than a 50% reduction in both frequency and birds per count period, and nearly 50% decrease in density. The Japanese white-eye showed an increasing trend in each of the parameters, with a particularly significant increase in density and birds per count period for this introduced species (Figure 8).

DISCUSSION

Native bird populations

The Hawaiian Hawk was the only endangered forest bird found within the study area during the current field survey. 'O'u were located in the northwestern corner of the James Campbell Estate lands in the former Wao Kele O Puna reserve and in what is now

Introduced bird populations

Next to habitat loss and fragmentation, introduced species of plants and animals represent the greatest threat to the remaining populations of Hawaiian species of plants and animals. Of particular concern are predator populations, specifically rats (*Rattus* spp.), feral cats (*Felis catus*), and mongooses (*Herpestes auropunctatus*), that directly impact the native bird species in an area, as well as introduced birds that compete with the native forest birds for available resources, and may serve as introduction points or reservoirs for avian diseases.

Several species of birds appear to have become established within the project area since the 1979 forest bird surveys were conducted. These species include the Kalij pheasant, Saffron finch, and possibly several species of unidentified parrots or parakeets that were detected during the current surveys. The Japanese white-eye, first introduced to the O'ahu in 1929 and to the island of Hawai'i in 1937, is now found in all habitats on all of the major Hawaiian islands, and is believed to be a significant competitor with many of the native forest birds (Mountainspring and Scott 1985).

MANAGEMENT OF POTENTIAL IMPACTS OF THE PROPOSED GEOTHERMAL DEVELOPMENT ON NATIVE FOREST BIRD POPULATIONS

Geothermal resource development may affect the native forest bird populations found within the project area in several ways. These include habitat loss or degradation resulting from road construction and site clearing, increasing overall predator population populations within the forest bird habitat, creating more access routes for introduced predators to travel through forest bird habitat, increasing access routes for more potentially competitive introduced bird species into the native bird habitat, and enhancing conditions for avian disease within this habitat.

The results of the field studies conducted during this project provide information pertinent to determining the current status of native and introduced forest bird populations within portions of the study area and an evaluation of some of the potential impacts of the proposed geothermal development program within the three subzones. However, a more complete evaluation of the research objectives cannot be obtained without further field work on the study components that were eliminated from this project due to denied access into significant portions of the proposed development area.

The following recommendations are presented as possible steps to minimize the impacts of the proposed geothermal development on native forest bird populations within the Puna subzones.

1. Complete forest bird surveys as originally planned. Due to limited land access, many portions of the study area were not surveyed during this project. As a result, the new data presented in this report do not display a complete picture of the current

LITERATURE CITED

- Ambrose, S. 1989. The Australian bird counts - have we got your numbers? RAOU Newsletter. Published by Royal Australasian Ornith. Union, Moonee Ponds, Victoria, Australia, 80:1-2.
- Atkinson, I.A.E. 1977. A reassessment of factors, particularly *Rattus rattus* L., that influenced the decline of endemic forest birds in the Hawaiian Islands. Pacific Science 31:109-133.
- Banko, W.E., and P.C. Banko. 1976. Role of food depletion by foreign organisms in historical decline of Hawaiian forest birds. Pages 29-34 in C. W. Smith, editor, Proceedings. First Conference in Natural Sciences, Hawaii Volcanoes National Park. Cooperative National Park Resources Studies Unit, Department of Botany, University of Hawaii, Honolulu. 243 pp.
- Bystrak, D. 1981. The North American Breeding Bird Survey. Pp. 34-41 in: C.J. Ralph and J.M. Scott, editors. Estimating the numbers of terrestrial birds. Stud. Avian Biol. 6.
- Berger, A. J. 1981. Hawaiian Birdlife. Second Edition. University Press of Hawaii, Honolulu. 274 pp.
- Ebenhard, T. 1988. Introduced birds and mammals and their ecological effects. Swedish Wildlife Research Viltrevy 13: 5-107.
- Freed, L.A., S. Conant, and R. C. Fleischer. 1987. Evolutionary ecology and radiation of Hawaiian passerine birds. Trends in Ecology and Evolution 2: 196-203.
- Jacobi, J.D. 1985. Summary of the biological information collected during the U.S. Fish and Wildlife Service's Hawai'i Forest Bird Survey in the Puna study area on the island of Hawai'i. USFWS, Mauna Loa Field Station, unpubl. report. 18 pp.
- Jacobi, J.D. and J.M. Scott. 1985. An assessment of the current status of upland habitats and associated endangered species on the island of Hawaii. Pages 3-22 in: C.P. Stone and J.M. Scott, editors. Hawaii's Terrestrial Ecosystems, Preservation and Management. Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. 584 pp.
- Kirch, P.V. 1982. The impact of the prehistoric Polynesians on the Hawaiian ecosystem. Pacific Science 36:1-14.
- Mountainspring, S., and J.M. Scott. 1985. Interspecific competition among Hawaiian forest birds. Ecological Monographs 55:219-239.

Warner, R. E. 1968. The role of introduced diseases in the extinction of the endemic Hawaiian avifauna. Condor 70:101-120.

Table 2. Species detected during point count surveys in habitats located within the two lower subzones in the Puna study areas.

Species	Number of birds detected	Detection rate (birds/hour)
'Amakihi	89	8.9
'Apapane	78	7.8
Common myna	139	13.9
Domestic goose	1	0.1
Domestic rooster	24	2.4
Golden plover	9	0.9
Hawaiian hawk	6	0.6
House finch	252	25.2
Japanese white-eye	286	28.6
Melodious laughing-thrush	19	1.9
Northern cardinal	145	14.5
Nutmeg mannikin	163	16.3
Parrot sp.	3	0.3
Red-billed leiothrix	5	0.5
Spotted dove	63	6.3
Unknown	1	.01
Zebra dove	21	2.1



...y area showing the three geothermal subzones

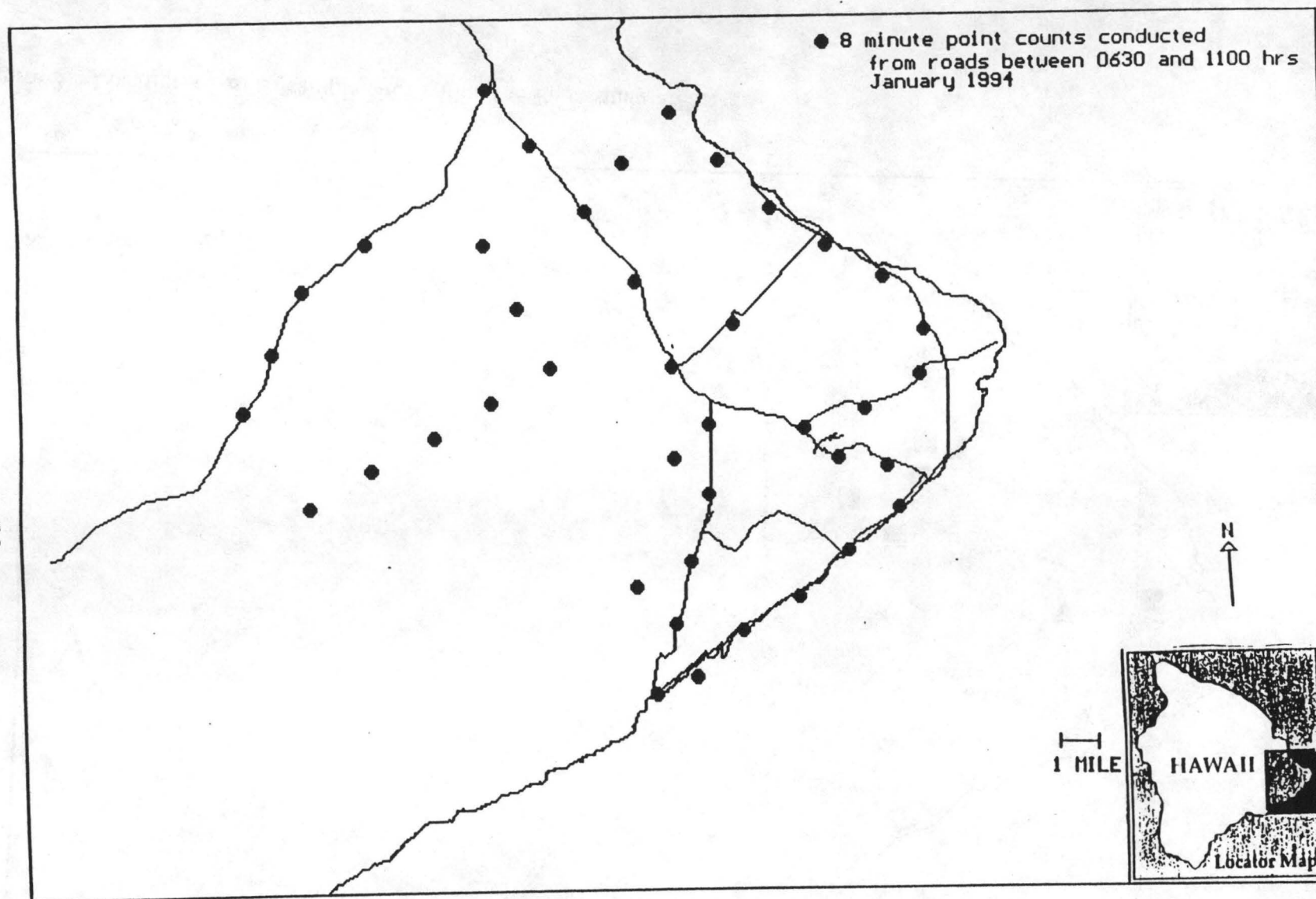


Figure 2. Location of AS and IPS sample sites within Puna study area.

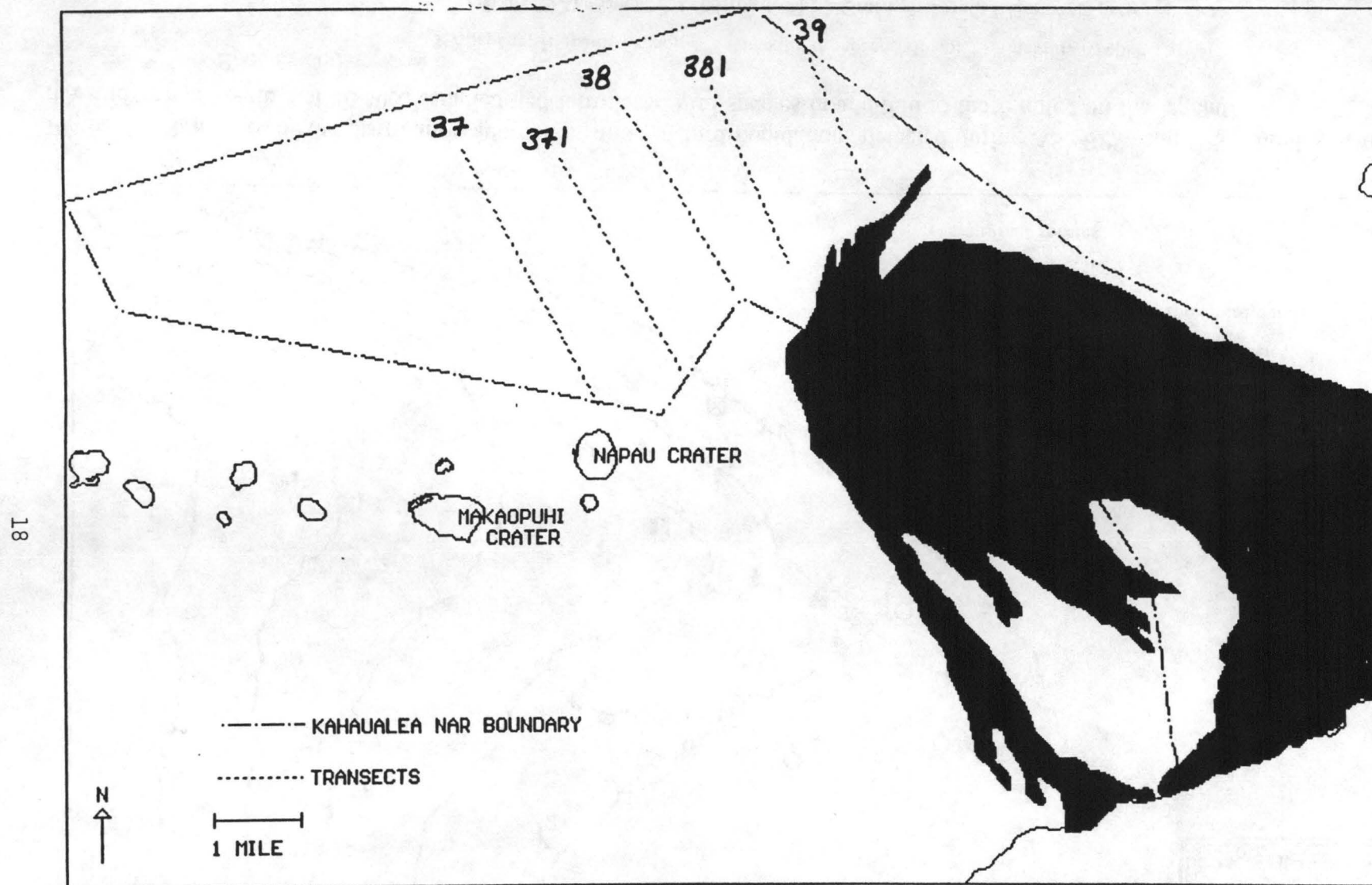


Figure 4. Map of transects sampled using VCP method within the Kahauale'a Natural Area.

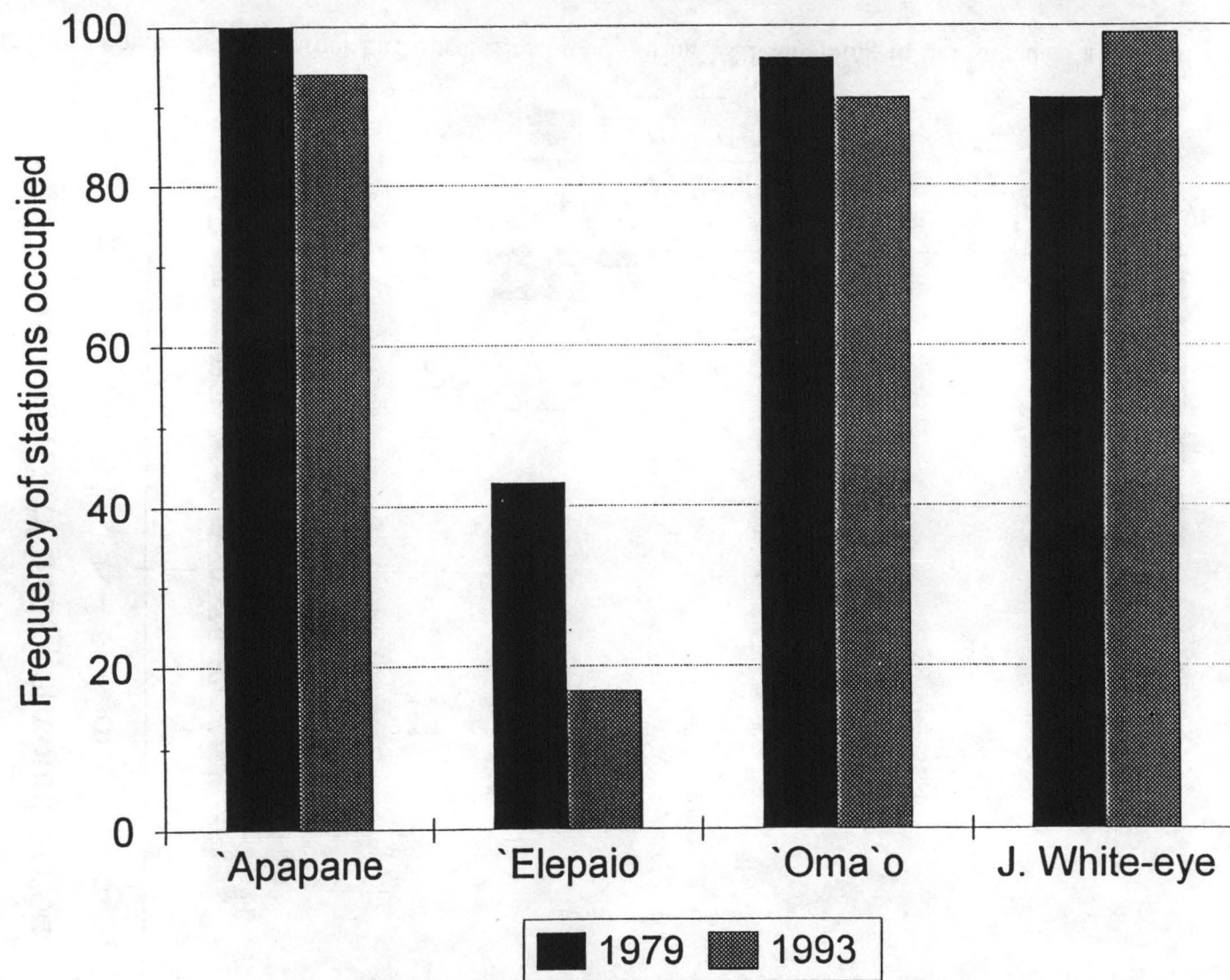


Figure 6. Frequency of stations occupied by four bird species recorded during VCP sampling in the Kahauale'a Natural Area Reserve in 1979 and 1993.

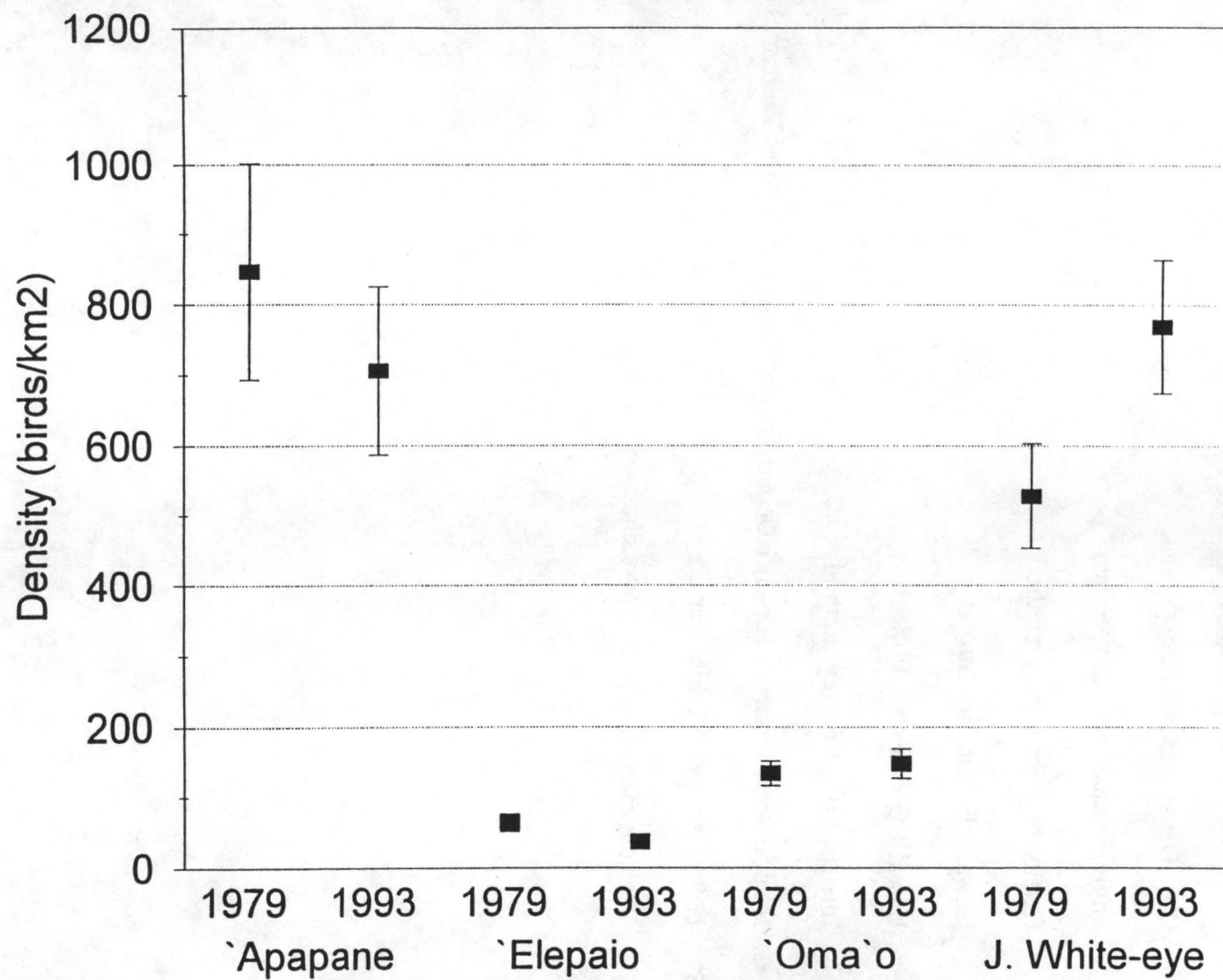


Figure 8. Density of four bird species recorded during VCP sampling in the Kahauale'a Natural Area Reserve in 1979 and 1993.